ROADWAY LOW IMPACT DEVELOPMENT PROJECT
FOUR CORNERS NEIGHBORHOOD

Montgomery County, Maryland
MT Project No. 5182-13

STORMWATER MANAGEMENT RETROFIT PRELIMINARY ASSESSMENT REPORT

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Prepared for:

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I. INTRODUCTION

The Montgomery County Department of Environmental Protection is proposing Low Impact Development (LID) stormwater best management practices (BMP) within the Four Corners neighborhood in Silver Spring, Maryland. McCormick Taylor has identified and evaluated one hundred seventy-six LID opportunities within the neighborhood in order to provide stormwater management of runoff from impervious surfaces to the maximum extent practicable (MEP). The proposed stormwater facilities will be installed coincident with roadway maintenance and/or rehabilitation to be completed by Montgomery County Department of Transportation (MCDOT). Construction is anticipated to begin in Spring 2012.

II. SOURCES OF INFORMATION

The sources of information provided for use in determining the appropriate LID feature for each site included:

- GIS Mapping
- Aerial Photos
- Field Investigation

III. LOW IMPACT DEVELOPMENT (LID) OPPORTUNITIES

The Four Corners neighborhood is located south of I-495 Capital Beltway, east of MD 193 (University Blvd) and north of Piney Branch Road in Silver Spring, Maryland. The project area consists of the Clifton Park Village, Montgomery Knolls and Franklin Knolls communities. The surrounding land use includes residential, commercial, institutional and forested areas. Eleven storm drain outfalls were identified within the project limits as study point locations. A small portion of the project drains towards MD 193 (University Blvd) and was not included in the overall study point calculations. However, this area was evaluated for potential LID sites. One hundred seventy-six sites were identified as possible areas for LID implementation.

Due to the large project area, the project was broken into four phases: Phase 1 – Clifton Park Village, Phase 2 and Phase 3 – Montgomery Knolls and Phase 4 – Franklin Knolls. The phases were determined by the study area boundaries.

SITE SELECTION

Field assessments were completed in April 2011 to identify possible LID opportunities within the project limits. Field mapping was generated with GIS information provided by Montgomery County which included property boundaries, utilities, contours and topographic features. Potential sites were chosen based on available space within the right of way, utility or vegetation conflicts, proximity to existing storm drain systems, existing drainage patterns and property ownership. In some neighborhoods, the existing site conditions greatly limited the amount of potential LID opportunities identified.

TYPES OF LID FACILITIES

LID features proposed throughout the project include bioretention, rain gardens, tree box filters, pavement removal and pervious sidewalks. Curb extensions were investigated,

however the width of the existing roadway and the amount of vehicles parking on the street reduced the feasibility of this type of LID feature.

Bioretention facilities and/or tree box filters were proposed in areas where an existing storm drain inlet or pipe was in close proximity. Tree box filters were utilized where available space was limited, utility or vegetation conflicts existed and/or to protect bus stops. Both types of facilities capture and filter runoff through layers of planting soil, sand and gravel prior to entering an underdrain system and ultimately the storm drain system. The tree box filters also incorporate a decorative grate and tree or shrub to increase nutrient uptake and improve aesthetics. A downstream storm drain inlet is required as an overflow or bypass structure to capture runoff from the larger storm events.

Rain garden facilities are similar to bioretention facilities, however they do not have an underdrain system and rely on the existing ground to infiltrate the filtered runoff. These facilities were proposed in areas where storm drain is not available. Infiltration tests will be completed in areas where rain gardens are proposed to ensure adequate infiltration rates. If infiltration rates are insufficient, bioswales or grass swales with amended soils may be proposed to help filter pollutants from the stormwater runoff.

Several areas of pavement removal are also proposed. The majority of the pavement removal consists of concrete walkways that exist between the sidewalk and roadway in order to provide additional space for the appropriate LID retrofit. Additionally, removal of the existing roadway pavement is proposed at the end of Langley Drive (Study Point A), the end of Miles Street (Study Point B) and end of McAlpine Road (near Study Point I) to provide additional space for LID retrofits.

Sidewalk replacement with pervious pavement is being analyzed throughout the entire project area. Study Area A contains no existing sidewalks, therefore pervious sidewalks will not be proposed in this area. Pervious pavement acts in the same manner as rain gardens in that they rely on the existing ground to infiltrate filtered runoff. Infiltration tests will be completed to ensure adequate infiltration rates. Pervious pavement features will utilize a 2" overdrain (lying beneath the pervious surface, on top of the sub base) to prevent pooling above the sidewalk and ensure structural stability against freeze thaw scenarios. Design parameters/conflicts that may limit the extent of pervious pavement installation include >5% slopes, tree root impacts, utility conflicts, inadequate infiltration rates, and Type D hydrologic soils. Installation of pervious sidewalks will be coordinated with Montgomery County DOT's scheduled sidewalk improvements.

PHASE/STUDY POINT SUMMARIES

PHASE 1 – CLIFTON PARK VILLAGE

Study Area A

Study Point A is located at a storm drain outfall at the end of Langley Drive, between 8901 Miles Street and 924 Heron Drive. The drainage area to the outfall is 35.09 acres, approximately 34% impervious, and consists of residential and commercial (Sspc Childrens Center) areas. Drainage areas for all study points were established by overlaying field reconnaissance information onto Montgomery County GIS mapping.

Based on the preliminary field visits, twenty one sites were identified as possible LID retrofit locations: 5 bioretention facilities, 2 tree box filters and 14 rain gardens. Storm drain


Legend
Study Points
Study Point Drainage Areas
WATERFORD RD
CHERRY TREE LA
W495-N193 RAMP
IL495 X29 TO X28 HWY
N193-E495 RAMP
MC ALPINE RD
LAWNSBERRY TER
BURGESS LA
TORRINGTON PL
MERWOOD LA
VANCE PL
MC ALPINE CT
CURRAN RD
FRANKLIN AVE
GARWOOD ST
BILTMORE DR
DEARBORN AVE
MOSS AVE
GREER AVE
WHITAKER TER
LOWANDER LA
GREGORIO DR
MALIBU DR
WEAVER ST
MELBOURNE AVE
UNIVERSITY BLV
WILMER ST
MINTWOOD ST
WHITNEY ST
WENDELL ST
LONG BRANCH PKW
GLENVILLE RD
GLOUSTER KNOLL DR
CORNWALL ST
COMPTON ST
DALEVIEW DR
COLONY RD
BUCKINGHAM DR
SALTER RD
LOUDEN CT
WAYNE AVE
SEPTEMBER LA
LINTON ST
PATTON DR
NEWHALL ST
MILES ST
KIMES ST CUT THRU
MALCOLM DR
KIMES ST
LANGLEY DR
HERON DR
HERON CT
PICKWICK VILLAGE TER
GARLAND
HINSDALE CT
HINSDALE AVE
HINSDALE LA
GARLAND AVE
ARLISS ST
J
K
I
G
H
E
F
D
C
B
A
Four Corners Study Points
0 350 700 Feet
1 inch = 700 feet
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MONTGOMERY COUNTY MARYLAND
McCormick Taylor
Engineers & Planners Since 1946

facilities are limited within this area. Seventy nine percent or 27.62 acres of the area draining to the study point is directed to proposed LID features. Approximately 8,469 cubic feet of stormwater management treatment volume will be provided by the LID retrofits within this Study Area.

Study Area B
Study Point B is located where runoff concentrates at the corner of Miles Street and Patton Drive and flows into a severely eroded channel on M-NCPPC property. The drainage area to the channel is 9.21 acres, approximately 35% impervious, and consists of residential and forested areas.

Four sites were identified as possible LID retrofit locations: 1 bioretention facility and 3 rain gardens. Almost one hundred percent or 9.18 acres of the area draining to the study point is directed to proposed LID features. Approximately 1,961 cubic feet of stormwater management treatment volume will be provided by the LID retrofits within this Study Area.

PHASE 2 – MONTGOMERY KNOLLS

Study Area C
Study Point C is located at the confluence of two storm drain outfalls behind 9200 Daleview Court. The drainage area to the outfall is 49.85 acres, approximately 32% impervious, and consists of residential, institutional (Mt Jezreel Baptist Church) and forested areas.

Forty-one sites were identified as possible LID retrofit locations: 11 bioretention facilities, 3 tree box filters and 27 rain gardens. Sixty percent or 29.83 acres of the area draining to the study point is directed to proposed LID features. Approximately 11,785 cubic feet of stormwater management treatment volume will be provided by the LID retrofits within this Study Area.

PHASE 3 – MONTGOMERY KNOLLS

Study Area D
Study Point D is located at a storm drain outfall between 815 and 817 Malibu Street. The drainage area to the outfall is 13.29 acres, approximately 39% impervious, and consists of residential areas.

Nineteen sites were identified as possible LID retrofit locations: 2 bioretention facilities, 1 tree box filter and 16 rain gardens. Eight-one percent or 10.71 acres of the area draining to the study point is directed to proposed LID features. Approximately 5,916 cubic feet of stormwater management treatment volume will be provided by the LID retrofits within this Study Area.

Study Area E
Study Point E is located at a storm drain outfall between 804 and 808 Lowander Lane. The drainage area to the outfall is 14.25 acres, approximately 40% impervious, and consists of residential areas.

Twenty-six sites were identified as possible LID retrofit locations: 7 bioretention facilities and 19 rain gardens. Seventy eight percent or 11.14 acres of the area draining to the study point is directed to proposed LID features. Approximately 5,958 cubic feet of stormwater management treatment volume will be provided by the LID retrofits within this Study Area.

Study Area F
Study Point F is located at a storm drain outfall across the street from 512 Melbourne Avenue. The drainage area to the outfall is 11.38 acres, approximately 35% impervious, and consists of residential, institutional (Eastern Middle School) and forested areas.

Eight sites were identified as possible LID retrofit locations: 4 bioretention facilities and 4 rain gardens. Eighty two percent or 9.28 acres of the area draining to the study point is directed to proposed LID features. Approximately 2,602 cubic feet of stormwater management treatment volume will be provided by the LID retrofits within this Study Area.

Study Area G
Study Point G is located at a storm drain outfall between 9427 and 9429 Curran Road. The drainage area to the outfall is 4.99 acres, approximately 23% impervious, and consists of residential and institutional (Eastern Middle School) areas.

One site was identified as possible rain garden retrofit location. Nine percent or 0.47 acres of the area draining to the study point is directed to the rain garden. Approximately 174 cubic feet of stormwater management treatment volume will be provided by the rain garden within this Study Area.

PHASE 4 – FRANKLIN KNOLLS

Study Area H
Study Point H is located at a storm drain outfall across the street from 812 Franklin Avenue. The drainage area to the outfall is 37.23 acres, approximately 33% impervious, and consists of residential, institutional (Eastern Middle School) and forested areas.

Twenty-six sites were identified as possible LID retrofit locations: 7 bioretention facilities, 1 tree box filter and 18 rain gardens. One of the bioretention facilities is proposed outside the right of way on school property (Eastern Middle School). Sixty-three percent or 23.32 acres of the area draining to the study point is directed to proposed LID features. Approximately 14,828 cubic feet of stormwater management treatment volume will be provided by the LID retrofits within this Study Area.

Study Area I
Study Point I is located at a storm drain outfall across the street from 9510 McAlpine Road, near the end of Vance Place. The drainage area to the outfall is 4.16 acres, approximately 35% impervious, and consists of residential areas.

Six sites were identified as possible LID retrofit locations: 3 bioretention facilities and 3 rain gardens. One of the bioretention facilities is proposed near the storm drain outfall outside of the right of way on M-NCPPC property. Ninety five percent or 3.96 acres of the area draining to the study point is directed to proposed LID features. Approximately 1,550 cubic feet of stormwater management treatment volume will be provided by the LID retrofits within this Study Area.

Study Area J
Study Point J is located at the confluence of two storm drain outfalls behind 9617 McAlpine Road. The drainage area to the outfall is 16.46 acres, approximately 37% impervious, and consists of residential and forested areas.

Nineteen sites were identified as possible LID retrofit locations: 3 bioretention facilities, 1 tree box filter and 15 rain gardens. Eighty three percent or 13.66 acres of the area draining to the study point is directed to proposed LID features. Approximately 5,697 cubic feet of stormwater management treatment volume will be provided by the LID retrofits within this Study Area.

Study Area K

Study Point K is located at a storm drain outfall between 9707 and 9709 Merwood Lane. The drainage area to the outfall is 0.76 acres, approximately 51% impervious, and consists of residential areas.

Two sites were identified as possible rain garden retrofit locations. Forty two percent or 0.32 acres of the area draining to the study point is directed to proposed LID features. Approximately 414 cubic feet of stormwater management treatment volume will be provided by the LID retrofits within this Study Area.

MD 193 - University Boulevard

A portion of the neighborhoods within our project limits drain towards MD 193 – University Boulevard and eventually into the State Highway Administration (SHA) storm drain system. A study point was not established at the SHA storm drain system outfall however the contributing drainage area located within our project limits was evaluated for LID opportunities.

Three sites were identified as possible LID retrofit locations: 1 bioretention facility and 2 rain gardens. The drainage area and target stormwater management volumes for this area were calculated based on the combination of the contributing drainage areas to the three proposed LID retrofit sites.

Table 1: Study Area Summary

Study Area	Drainage Area (ac)	Percent Impervious	Target ESDv (cf)	Concept Volume Provided (cf)	No. of LID Sites
A	35.09	34%	81,561	22,993	21
B	9.21	35%	21,944	5,574	4
C	49.85	32%	108,113	11,785	41
D	13.29	39%	35,039	15,508	19
E	14.25	40%	37,881	16,782	26
F	11.38	35%	26,430	8,799	8
G	4.99	23%	7,348	2,000	1
H	37.23	33%	81,622	32,325	26
I	4.16	35%	10,004	4,787	6
J	16.46	37%	39,978	15,590	19
K	0.76	51%	2,542	795	2
MD 193	0.96	39%	2,250	773	3
Project Totals	**197.63**		**454,712**	**137,711**	**176**

The concept volume provided in Table 1 includes concept volumes for proposed LID retrofits, pervious sidewalk (where applicable) and RainScapes treatment. The concept volume provided is approximately 30% of the target Environmental Site Design (ESD)

volume. Refer to the Appendices for Study Area summaries and individual LID computations.

LID STORMWATER MANAGEMENT COMPUTATIONS

Target stormwater management (SWM) volumes were calculated for each Study Area and individual LID retrofit site. Conceptual treatment volumes were calculated for each proposed LID facility. SWM volumes calculated included the Water Quality Volume (WQv), Environmental Site Design Volume (ESDv), 1-Year Volume Maximum and Concept Volume Provided. Variables such as drainage area, impervious area and hydrologic soil type were used in computing the volumes. The volumes were based on the guidelines within the *2000 Maryland Stormwater Design Manual – Volumes I and II* and the 2009 revisions.

Water Quality Volume (WQv):
The Water Quality volume is the storage needed to capture and treat one inch of runoff based on the drainage area and percent of the area that is impervious. Drainage areas for each LID feature were established by overlaying field reconnaissance information onto Montgomery County GIS mapping. Due to the size of each LID drainage area, the land uses were simplified into impervious area, open space and forest. The impervious areas were further broken down into roadway and driveway aprons within the right of way, sidewalks within the right of way and impervious areas on private property, which includes driveways, walkways and rooftops per DEP's request.

Environmental Site Design Volume (ESDv):
The Environmental Site Design volume is the storage needed to reduce the runoff from a site to a level equivalent to a wooded site in good condition. Based on the drainage area, impervious cover, RCN and hydrologic soil types, rainfall targets, runoff depths and ESDv are calculated based on Table 5.3 in the *2000 Maryland Stormwater Design Manual.*

1-Year Volume Maximum:
The 1-year maximum volume represents the amount of runoff generated by the 1-year storm event based on the drainage area and percent impervious. This volume is similar to the water quality volume however the runoff is based on the 1-year rainfall rather than one inch of runoff. The 1-year 24-hour rainfall for Montgomery County is 2.6 inches.

Concept Volume Provided:
The treatment provided by each proposed LID facility was calculated based on the available square footage within the right of way to install that specific type of facility. Based on a comparison of concept volumes versus design volumes for the Forest Estates community (Subtask A), the square footage was multiplied by 40% to achieve the concept volume.

The concept volume provided by a tree box filter was determined by using the maximum allowable drainage area (per Filterra® Quick Sizing chart) for the proposed box size and assuming the area was 100% impervious. Because the allowable treatment credit accepted by Montgomery County and MDE has not been determined, the treatment provided was assumed to be 50% of the calculated water quality volume.

Calculations for the hydrologic and hydraulic variables and SWM volumes are located in Appendix B on the Unified Stormwater Management Sizing Spreadsheets.

RAINSCAPES PROGRAM COORDINATION

Based on the available space located within the Montgomery County right of way, full treatment of the contributing drainage area to the majority of the proposed LID features is difficult. In most cases, additional upstream LID features are not feasible or practical due to utility and vegetation conflicts or the level of treatment that could be provided.

However, the Montgomery County DEP RainScapes Program promotes and implements projects on residential, institutional, and commercial properties to reduce stormwater runoff. Eligible RainScapes techniques include; rain gardens, conservation landscaping, tree canopy, permeable pavers, green roofs and rain barrels. Incorporating the RainScapes features on private property has the potential to increase the overall stormwater management provided within the neighborhood and project limits. For the calculations included in this report, it was assumed that RainScapes facilities will treat approximately fifteen percent of the ESD volume for each Study Area.

IV. CONCLUSION

The proposed Low Impact Development (LID) stormwater best management practices (BMP) within the Four Corners neighborhood are intended to capture, treat and filter runoff from the existing impervious surfaces. The one hundred seventy-six proposed LID features; forty-four bioretention facilities, eight tree box filters and one hundred twenty-four rain gardens, have the potential to provide 137,711 cubic feet of treatment (30% of the target ESD_v of 454,712 cf) within the neighborhood. Additional treatment may be achieved by installing pervious concrete and implementing RainScapes techniques. The proposed facilities will provide environmental benefits by reducing impacts from uncontrolled and untreated runoff, improve the aesthetics of the neighborhood where reasonably possible and provide opportunities for community education.